Claims

We claim:

1. A method for coding a packet of information words into frames for transmission, the method comprising:

receiving blocks of the input data, the input data including control words and the packet of information words, the packet having a start preceded by ones of the control words and an ending followed by others of the control words, the blocks being smaller than the packet and including a block;

determining when the block consists exclusively of information words;

when the block consists exclusively of information words, appending to the block a master transition having a first sense to form one of the frames;

when the block does not consist exclusively of information words:

condensing the block to accommodate a TYPE word; and

generating the TYPE word having a value that indicates one of the following structural properties of the block: (a) a position of the start of the packet in the block, (b) a position of the end of the packet in the block, and (c) the block being composed exclusively of control words, and inserting a TYPE word into the block, and

appending to the block a master transition having a second sense, opposite to the first sense, to form the one of the frames.

2. The method of claim 1, in which condensing the block includes removing from the block a control word that indicates one of (a) the start of the packet and (b) the end of the packet.

3. The method of claim 2, in which condensing the block includes re-coding remaining ones of the control words using the fewer bits.

4. The method of claim 3, in which, in re-coding the control words using the fewer bits, the control words are re-coded using codes have a specified mutual Hamming distance.

5. The method of claim 1, in which compressing the block includes re-coding ones of the control words using the fewer bits.

6. The method of claim 1, in which the type word is selected from a set of type words in which all the type words have a specified mutual Hamming distance.

7. The method of claim 6, in which:

the type words each consist of T bits; and

the method additionally comprises generating the set of possible bit patterns by a process including:

adopting a $(T/2)$-bit binary pattern as a first half of a bit pattern in the set of possible bit patterns, and

generating a second half of the bit pattern by duplicating or complementing the first half of the bit pattern depending on a bit parity value of the first half of the bit pattern.

8. The method of claim 1, additionally comprising recoverably scrambling the block prior to preceding the block with the master transition.

9. The method of claim 8, in which:

each of the type words consists of T bits; and

in recoverably scrambling the block, the block is recoverably scrambled using a polynomial having coefficients separated by greater than T such that a single error in transmitting the frame, when the scrambling is recovered, will not cause multiple errors to fall within any of the type words and degrade a minimum Hamming distance of the type words.

10. A coder for coding blocks of input data into respective frames for transmission, the input data including control words and a packet of information words, the packet having a start preceded by ones of the control words and an ending followed by others of the control words, the blocks being smaller than the packet and including a block, the frames including a frame corresponding to the block, the coder comprising:

a type word generator that receives the block and generates a TYPE word for the block, the TYPE word having a value that indicates one of the following structural properties of the block: (a) whether the block is composed exclusively of control words, (b) a position of the start of the packet in the block, (c) a position of the end of the packet in the block, and (d) whether the block is composed exclusively of control words;

a master transition generator that operates in response to the TYPE word and generates a master transition in a first sense when the TYPE word indicates that the block is composed exclusively of information words, and otherwise generates the master transition in a second sense, opposite to the first sense;

a payload field generator that operates in response to the TYPE word and that adopts the block to form a payload field of the frame when the TYPE word indicates that the block is composed exclusively of information words, and that otherwise condenses the block and inserts the TYPE word into the block to form the payload field; and

a frame assembler that appends the master transition to the payload field to form the frame.

11. The coder of claim 10, in which the payload field generator includes a control word removal module that condenses the block by removing from the block a control word that indicates one of (a) the start of the packet and (b) the end of the packet.

12. The coder of claim 11, in which the payload field generator additionally includes a re-coder that condenses the block by re-coding remaining ones of the control words using the fewer bits.

13. The coder of claim 12, in which the re-coder re-codes the control words using codes having a specified mutual Hamming distance.

14. The coder of claim 10, in which the payload field generator includes a re-coder that condenses the block by re-coding remaining ones of the control words using the fewer bits.

15. The coder of claim 10, in which the type word is selected from a set of type words in which all the type words have a specified mutual Hamming distance.

16. The coder of claim 15, in which:

the type words each consist of T bits; and

the coder additionally comprises a type word generator that generates the set of possible bit patterns, the type word generator including:

a first-half generator that adopts a $(T/2)$-bit binary pattern as a first half of a bit pattern in the set of possible bit patterns, and

a second-half generator that generates a second half of the bit pattern by duplicating or complementing the first half of the bit pattern depending on a bit parity value of the first half of the bit pattern.

17. The coder of claim 10, additionally comprising a scrambler interposed between the payload field generator and the frame assembler.

18. The coder of claim 17, in which:

each of the type words consists of T bits; and

the scrambler is configured to operate using a polynomial having coefficients separated by greater than T such that a single error in transmitting the frame, when the scrambling is recovered, will not cause multiple errors to fall within any of the type words and degrade a minimum Hamming distance of the type words.